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Remarks by

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to the

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I am pleased to be invited to address this conference first because many of you are my friends and colleagues, second because I have something I particularly want to say. I hope you'll forgive me for speaking quite bluntly and perhaps being overly harsh but I'm sure most of you will agree. First, though, I'd like to bring to you the President's greetings and leave with Dean Bradford this message:

"Congratulations on the occasion of the 80th Annual Conference of the American Society for Engineering Education. I regret that the press of other duties prevents me from being with you at the Conference Dinner. You can be sure that I have an even greater appreciation of the need for "Engineering Involvement" since my recent travels abroad. In these times of increasing demands on the engineering profession to serve both the social and technological needs of mankind, your organization occupies a position of great importance. Keep up the good work in teaching and training the professional engineers who offer some of this country's greatest hopes for the future."

As the United States, Europe and Japan move from the Industrial Era into the beginning of the scientific and technology revolution, a period of uncertainty, confusion, disillusionment, and conflicting goals is bound to occur. We are confronted with far-ranging and sometimes bewildering extremes. On one fringe we have honest and sincere humanists who are dismayed by what they see as a de-humanizing process occurring, who are nostalgic for the "old days" of small world population in which an educated elite, out of touch with the world generally, had developed a camaraderie and intellectual life that humanists constantly strive to emulate. This educated elite had little communication specifically with the masses of people, and hence overlooked the fact that almost the entire world lived in semi-poverty, illiteracy, and in generally deprived conditions -- conditions which the elite of that day neither cared about or scarcely knew about. On the other fringe, we have the activists, sometimes violent, twentieth century Luddites who would destroy our society completely in order to rebuild it -- into they know not what -- in the hope that whatever new system arises, it can't be worse than our own. In between, we find some voices of moderation and reason, but we also find, unfortunately, the voices of masochism and self-flagellation bemoaning the change and causing some to lose confidence in the system that other parts of the world (even some communist societies) are seeking to emulate. Thriving on all this, I'm sorry to admit, are highly vocal doom-mongers in various walks of life who make a living on crises or pseudo-crises.

The transition from the Industrial Era into the new Era of Science and Technology has been taking place at an accelerating pace in recent years. Change is coming so rapidly that it has taken Middle America and the bulk of the academic community a while to sort out the facts and come to rational means to meet these cultural crises and to begin to prescribe mechanisms to bring this transition to pass in an orderly fashion. America is clearly the leader in this orderly transition as it has been during the latter part of the Industrial Era. It is particularly refreshing that the American Society for Engineering Education has as the theme for this conference, "Engineering Involvement."

To be sure, many of the modern Luddites* look at Engineering as the personification of science and technology which they see at the root of their problems. Wise persons are beginning to realize, however, that it is science and technology that has caused us to better understand societal world problems which have always existed or were perhaps compounded by the Industrial Era. For example, air pollution is as old as smoke, which has been a problem since man first congregated together in villages and with fire cooked food and heated houses.

* I might remind you that the Luddites were a secret society in England active during the years 1811-1813 who, masked, went about at night destroying machinery and factories because people were out of work.

Urban blight is not a peculiarity of an industrial society but a characteristic of a society in which its people have a pressing desire to share the cultural advantage of cities. Take a look at urban blight in Calcutta, Shanghai or Cairo or, if it were possible, ancient Rome. And finally, consider current environmental problems: To be sure, rapid increase in world population has accelerated such problems in recent decades but none can deny that the early photos of the earth -- beautiful blue, brown and white, floating in the darkness of space -- gave mankind the feeling of the essential finiteness of our biosphere and the urgent need to care for it and preserve its natural beauty.

In fact, many of our global ecosystem problems originally attributed to industrialization have since been shown to have existed from the beginning of history. A good example is the reason for carbon monoxide in the atmosphere. Since global measurement of such minute quantities (unlike CO₂ which exists in abundance) has been made only recently, it has been consistently believed that its presence resulted from automobile fumes. Recent data (derived incidentally from a study of other planets, Venus and Mars) has shown that nearly all carbon monoxide derives from a dissociation of methane by sunlight, such methane coming primarily from two well-known sources: swamp gas and rice fields.

What science and technology have done, partly through the new communication media which almost overnight became world-wide, and partly through education, through the space program, and through research at universities, is to cause a genuine awareness of this transitional period, at least in Europe, America and Japan. What is important now is to go about the business of providing a smooth transition to a new era, at least partly through this same science and technology, rationally, without loss of perspective and without losing the world leadership which brought us to this position. Engineers can and should be involved in this process, especially young engineers. My seven years as a University President convinced me that young people need not only emotional involvement but productive involvement as well.

Emotional Involvement usually deals principally with reforming our system of distributing the good things in life; it obviously appeals to many of our best young people; at least it is filling up our law schools. But it is only common sense that a country must produce before it can distribute, and in modern society engineers are among the prime producers.

But there is more to Engineering Involvement today than keeping the country productive. I believe young engineers will want, in the course of their careers, to have a greater voice in deciding what to produce as well as how to produce. They will want to have their say, and our society will need their advice, on what is useful and not useful for man.

The engineer's main contribution to the decision-making process has traditionally been to determine feasibility, whether the decision involved the introduction of non-returnable bottles or sending the first men to the Moon. If engineers want to get more deeply involved in the decision-making process, to help determine desirability as well as feasibility, then they probably do need a broader education than we have been giving them.

I do not mean that they should be educated to dominate the decision-making process. I mean that perhaps we should give our engineering students a better idea about who the other members of the decision-making team are, how they think, and what their role in the process is.

Now the engineer, as a good citizen, may give freely of his spare time and his professional knowledge to the solution of problems at the local level. He may advise the Town Council on a traffic problem, or the School Board on changes in the math courses. NASA employees are encouraged to do this, and of course it is beneficial.

But at higher levels of government, and in most of industry, additional Engineering Involvement will have to be paid for, in terms of salaries, laboratories, and more comprehensive engineering education, to name some obvious costs.

The major long-term decision before our nation today is how to make more use and better use of advanced technology to increase the productivity of industry and to enhance the quality of American life.

This is a problem which is very much on the mind of the President. It is something he would have wanted to talk to you about at some length if he could have been here tonight.

On March 16 of this year, the President sent to Congress the first Presidential message in the history of this nation on the special subject of Science and Technology. It has been hailed as a landmark message, a challenging message. Among other things, it makes greater Engineering Involvement, in the best sense of the word, part of basic national policy. It is backed by budget actions, such as a recommended 12 percent increase in federal support for university R & D, and an increase of \$700 million in the coming fiscal year for R & D on such matters of national concern as energy, transportation, and the environment. It proposes government actions to encourage private investment in R & D.

I believe that anyone reading the President's message will be impressed by its "pro-science" and "pro-technology" recommendations. I think that educators can make good use of this strong statement of national policy in discussing Engineering Involvement with present or prospective students.

Let me quote, for example, what the President said about the importance of technological innovation:

"The ability of the American people to harness the discoveries of science in the service of man has always been an important element in our national progress.... But the accomplishments of the past are not something we can rest on. They are something we must build on. I am therefore calling today for a strong new effort to marshal science and technology in the work of strengthening our economy and improving the quality of our life. And I am outlining ways in which the Federal Government can work as a more effective partner in this great task.

"The importance of technological innovation has become dramatically evident in the past few years. For one thing, we have come to recognize that such innovation is essential to improving our economic productivity -- to producing more and better goods and services at lower costs. And improved productivity, in turn, is essential if we are to achieve a full and durable prosperity -- without inflation and without war. By fostering greater productivity, technological innovation can help us to expand our markets at home and abroad, strengthening old industries, creating new ones, and generally providing more jobs for the millions who will soon be entering the labor market.

"This work is particularly important at a time when other countries are rapidly moving upward on the scientific and technological ladder, challenging us both in intellectual and in economic terms. Our international position in fields such as electronics, aircraft, steel, automobiles and shipbuilding is not as strong as it once was. A better performance is essential to both the health of our domestic economy and our leadership position abroad.

"At the same time, the impact of new technology can do much to enrich the quality of our lives. The forces which threaten that quality will be growing at a dramatic pace in the years ahead. One of the great questions of our time is whether our capacity to deal with these forces will grow at a similar rate. The answer to that question lies in our scientific and technological progress."

End quotation.

The orderly transition of our society and, more particularly, our nation into this new Era of Science and Technology will be accomplished by a sort of Troika (forgive the expression) of government, industry, and the education community. The President has set guidelines for all three backed by appropriate budget allocations to each.

As John McHale has said in his ecosystems-analytic approach to the future: "Space technology has provided the key image of scientific and technical progress for years....Almost every branch of science, physics, chemistry, etc., through biology, medicine, to psychology, to parapsychology, and all forms of engineering have been pressed into its development.....To transport and maintain the human organism off the earth and outside its sustaining envelopes requires a duplication of the earth itself...."

The space program provides us an encouraging case history of government leadership for this Troika in a vital new area of technology. The creation of the National Aeronautics and Space Administration and the decision to rapidly expand our space capabilities by sending men to the Moon were in response to what was judged to be a crisis situation.

But when the national goal of the first lunar landing had been achieved, the country faced difficult new decisions on what level of space effort we wanted to make in the decade of the 1970's. The great stimulus of competition with the Soviet Union was lacking, but there was a new recognition of many practical benefits and scientific rewards to be won from further efforts to explore and use space.

I am happy to say that these difficult decisions on the space program of the Seventies have now been made. NASA has faced up to the problem of identifying the first priority programs to undertake at this time. The President has backed us with what amounts to a stabilized budget at about the current level of \$3.4 billion during the rest of this decade. We have received strong bi-partisan support in Congress.

So we have moved from a decade of crisis response in space to a decade of highly rational space use. As the President expressed it in his Science and Technology Message, "We are reorienting our space program to focus on domestic needs -- such as communications, weather forecasting, and natural resource exploration. One important way of doing this -- the President continued -- is by designing and developing a reusable Space Shuttle, a step which would allow us to seize new opportunities in space with higher reliability at lower costs."

To move into this new Era of Science and Technology on a global basis, which surely is a necessity for long-term preservation of our precious planet Earth, will require extensive but meaningful cooperation among all nations. Fortunately, the world, which has in recent times been made one, came to this condition not so much by political machinery or ideological innovation as by science and modern technology. Space may be the sine qua non of this unity.

The President recognizes this in his policy for a growing world partnership in science and technology, including "important links with countries which have different political systems from ours." Needless to say, we are very pleased at NASA with the agreement the President signed in Moscow for a rendezvous and docking test to be carried out in 1975 with our Apollo spacecraft and the Soviet Soyuz spacecraft.

The real significance of this mission is all the cooperative effort and all the exercise of good will that must precede it. And what is more important still is the breakthrough this one scheduled test could achieve in the direction of future cooperation.

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The rendezvous and docking experiment in 1975, said a recent editorial in the New York Times, has "immense political significance," and "is obviously only a first step. Ahead lie the creation of a joint Soviet-American earth orbital laboratory, a joint permanent manned station on the Moon, and eventually a Soviet-American manned expedition to Mars. And, with each step of shared activity in space, cooperation on Earth can be expected to become easier and more habitual."

I find such projections very encouraging, for the future of the space program and for the future of the engineering profession.

The space program has demonstrated the great technological advances that this country can make in response to clear national goals and with a long-term commitment of adequate funds.

The time has come, I believe, to apply the lessons learned in the space program to other areas of growing national concern.

One such area is the deficit of \$1.5 billion that showed up last year in our balance of trade. It was our first trade deficit since 1893.

Our best earner in the foreign trade statistics is the commodity group known as technology-intensive manufactured products. These products showed a trade surplus of about \$8.3 billion in 1971, so you can see the trouble we would be in if it were not for our technology-intensive products. But even in this area we are beginning to slip. Imports of technology-intensive products increased faster in 1971 than exports.

Many steps can be taken by government and industry to help protect our balance of trade. One long-range approach to the problem is a more effective R & D effort in all technology-intensive industries. But I must emphasize that this approach is long-range -- it cannot be planned and implemented from one year to the next. In particular, it would require a steady supply of new engineering talent from our colleges.

NASA is working with industry on the advanced aeronautical research and development that is essential if we are to maintain our dominant position in aircraft sales abroad. We have sharply increased our aeronautical research efforts in recent years, but we shall have to keep a close watch on the foreign competition. We may have to move much faster than our present pace or lose important overseas markets.

The ultimate answers for urban transportation are less obvious as of now. The great flexibility and convenience of the automobile has spread our living patterns so that economically viable mass transportation systems have largely ceased to exist. We therefore are confronted with the almost intolerable congestion and pollution that accompanies the use of 4000 pound, 250 horsepower vehicles to transport an average of 1 1/2 people to and from our places of work.

We cannot legislate a solution because our way of life is built around the automobile. We shall have to devise new, modern transportation modes that offer comparable flexibility and convenience.

Another problem area which demands new technological concepts is that associated with our growing energy requirements. Our demands for more and more electrical energy to power our growing economy are beginning to conflict with our increasing concern over smoke, ash, and thermal pollution. Our power industry is finding it increasingly difficult to find acceptable sites for the needed new generating stations. The ultimate availability of economically viable low pollution fuels is being called into question. More and more we are hearing the phrase "energy crisis." Although there is really no crisis as such, it is increasingly evident that unless new, pollution-free methods of producing energy are developed, the price of new energy (in dollars and environmental contaminants) will severely limit man's continuing ability to use machines to do his work.

The problem is receiving increasing attention from the Federal government. In the nuclear field, increased effort is being applied to breeder reactors and controlled fusion devices. We at NASA are beginning to consider some of the developmental problems associated with the direct conversion of solar energy, an abundant form of energy that is pollution free.

These kinds of challenges that must be met by new technology concepts do not suggest any future lack of employment for engineers.

So it is on this optimistic note that I will close. As a representative of Government here tonight, I wish you the greatest success in your efforts to increase Engineering Involvement and engineering enrollments. I hope that on Government's part we can provide, in both you and your students, the confidence in a bright future for technology necessary to inspire those efforts. It would be difficult to overestimate the importance of your work. The future of this country and indeed the world depends more than ever on the knowledge, the dedication and, the increasing involvement of the young engineers you are training.

I thank you.